Manitoba Conservation
Forest Practices
Guidebook

PROTECTION OF SOFTWOOD UNDERSTOREY IN MIXEDWOOD AND HARDWOOD FORESTS

Valid until January 2008

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http://www.gov.mb.ca/conservation/forestry/forest-practices/fpp-contents.html

PREFACE

MANITOBA FOREST PRACTICES

This guidebook has been developed as part of the Forest Practices initiative of Manitoba Conservation. The Forest Practice initiative of Manitoba Conservation, led by the Forestry Branch, is intended to provide consistent operational direction for resource managers, timber operators, natural resource officers, and auditors to conduct or assess forestry activities.

One of the primary goals of the Forest Practice initiative is to advance "best" practices through guidelines and standards for sustainable forest management activities in Manitoba. Guidelines present alternative procedures or standards that can be applied to satisfy the principle upon which the guidelines are based. Specific guidelines are enforceable when identified on Work Permits. Forest Practice Guidebooks ensure all forest resource values are appropriately addressed during the full range of forest activities.

Forest Practices Guidebooks are one of several references available to resource managers, timber operators, natural resource officers, and auditors. References include provincial guidelines as well as Forest Management Plans, Annual Operating Plans and Standard Operating Procedures developed by each forest company.

Representatives from several branches of Manitoba Conservation (Forestry, Wildlife and Ecosystems Protection, Fisheries, Environmental Approvals, Parks and Natural Areas, etc.), the three major Forest Management Licencees in Manitoba (Tembec Industries Inc., LP Canada Ltd., Tolko Industries Ltd.), and the Forest Industry Association of Manitoba, representing timber quota holders cooperated in a consensus seeking manner to develop Forest Practice Guidebooks. Regional specialists participated when meetings were held in their respective regions.

All guidelines for a specific forest practice will be contained in a single guidebook. Each guidebook will also contain pertinent references to science, legislation, policy, agreements, and licences. Recommendations for the planning, implementation, monitoring, and enforcement of the specific forest practice in question will be included.

As much as possible the recommendations within each Forest Practice Guidebook will:

- be based on scientific evidence
- be measurable
- be practical
- be flexible and applicable in a variety of ecological conditions
- be clearly presented to enable consistent interpretation and application
- contain accepted terminology and definitions
- be reviewed and amended as required

The guidebooks are available for public comment on the Forestry Branch web site at: www.gov.mb.ca/conservation/forestry/forest-practices/fpp-contents.html

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SOFTWOOD UNDERSTOREY PROTECTION

PURPOSE

The purpose of understorey protection is to protect and release acceptable softwood understorey trees while harvesting merchantable trees from hardwood and mixedwood stands. The goals of understorey protection are to:

- Contribute to forest regeneration targets with natural regeneration.
- Shorten rotation age for subsequent softwood crop with advanced regeneration.
- Conserve and maintain tree genetic and species diversity.
- Protect and enhance the conifer wood supply within the forest land base.
- Reduce the forest renewal costs and time to re-establish conifer trees.

BACKGROUND

In mixedwood forest conditions softwood trees frequently occur beneath the overstorey. The hardwood trees within these forests may mature many years before the softwood trees are mature or commercially acceptable. Understorey protection is required to facilitate harvesting without jeopardizing the survival and growth of understorey softwoods, and perpetuation of mixedwood forests.

Research, trials and harvest operations have primarily focused on protecting white spruce growing beneath trembling aspen, balsam poplar and white birch. Many of the trials have occurred in Alberta but some have also taken place in Riding Mountain National Park and the Manitoba Model Forest.

Understorey protection strategies developed for application in various mixedwood forest conditions should be identified during the planning phase of forest operations. The specific understorey protection strategy and methods chosen for each proposed harvest block must be indicated in each Forest Management Licencee's Annual Operating Plan. Operators with the appropriate equipment and experience should be selected to carry out understorey protection to successfully protect understorey during harvest operations.

Discussions with Manitoba Conservation must occur and IRMT approval obtained if there is a need to significantly alter approved understorey protection strategies and protection methods because of forest conditions encountered.

ACCEPTABLE ADVANCED SOFTWOOD UNDERSTOREY TREES

Often the softwood understorey trees growing in association with hardwood/mixedwood overstories consist of white spruce, black spruce and balsam fir.

In Manitoba, white spruce and black spruce are considered acceptable commercial softwood understorey tree species and can be effectively managed to meet several of the goals of understorey protection. Understorey protection methods recommended in this document assume that the majority of the understorey is white spruce. If the understorey is dominated by black spruce however modifications may be required to achieve adequate protection and release.

Other tree species may be considered acceptable understorey trees if the management intent is to primarily achieve goals of protecting wildlife habitat and maintaining genetic and tree species diversity. Balsam fir is also an important tree for medicinal and ceremonial purposes.

Balsam fir should be protected in patches rather than single stems. Balsam fir patches provide cover and food for some wildlife, suffer less physical damage during harvest, and experience less injury and mortality from exposure when released. However, balsam fir, a preferred food of spruce budworm, will only be considered an acceptable understorey species when the risk of encouraging or sustaining a spruce budworm outbreak in a geographic area is low. Otherwise the widespread protection of balsam fir will be discouraged because of the associated spruce budworm risks and may be substituted with the planting of spruce seedlings. It should be noted that in some parts of the province, due to fire protection efforts and past forest management operations the amount of balsam fir in the understorey of mixedwood forests has increased.

Trees to be protected should be free of root and stem decay, stem cankers, and dwarf mistletoe. If large areas of softwood understorey are diseased or infected understorey strategies may not be appropriate.

FACTORS INFLUENCING UNDERSTOREY PROTECTION PRESCRIPTIONS

One of the primary concerns when selecting a protection strategy is the potential windfirmness of the softwood understorey. Windfirmness is an indication of the ability of the softwood understorey to withstand significant winds after the overstory has been removed. The determination of windfirmness is very complex. Even though many of the influences on windfirmness are understood the selection of the appropriate trees to protect, and the strategies to employ will largely be based on experience.

The windfirmness potential of understorey trees can be influenced by several factors. Consideration should be given to the following characteristics when selecting softwood trees for protection:

Height:

- trees should be less than 10 metres tall
- softwood understorey trees between 3 and 6 metres tall are ideally suited to protection
- softwood understorey trees between 3 and 6 metres tall may be supplemented with 1-3 metre and > 6 metre advanced growth with good windfirmness potential.

Age:

- trees between 15 and 40 years are preferred and will likely be chosen based on height
- trees selected for protection may be supplemented with younger and older trees

Rooting characteristics of the understorey tree species:

- white spruce roots extend in several directions to a moderate depth
- black spruce is relatively shallow rooted

Topography and aspect:

- avoid tops of hills and slopes exposed to prevailing winds

Proximity to other understorey trees:

- trees, in singles or patches, of the same or another species, around understorey trees will offer protection from wind and harvest damage

Crown length and it's distance from the ground:

- long crowns extending from the tree top to almost the ground are better than crowns only at the top portion of the trees

Soil moisture:

- preferred sites for employing understorey protection will have soils with low potential for soil moisture saturation

Slenderness Coefficient:

- trees with slenderness coefficients of < 100 (height cm / dbh cm) will possess better windfirmness potential

Some of these factors will be collected during pre-harvest surveys, however several of them will require personal knowledge of the geographic area and experience with understorey protection for the forest planner to prescribe the appropriate strategy. Even though maximum sizes and ages of softwood trees, which should be protected, are recommended it may be appropriate to occasionally leave larger, older trees. Some of these softwood trees may survive and contribute to the main goals of shortening rotation

ages and maintaining softwood wood supplies, or if mortality and windthrow occur they may still contribute to other goals related to biodiversity and wildlife habitat.

UNDERSTOREY PROTECTION STRATEGIES

The following table indicates the Understorey Protection Strategies currently available to Forest Planners and operators.

Table 1. Understorey protection strategies.

Strategy	EXTENSIVE	MODERATE	INTENSIVE
Average number of acceptable understorey stems/ha in pre-harvest survey	0-250	250-500	>500
Harvest type	Single pass harvest	Single pass harvest	Single or multi-pass
Forest Renewal System:			
Mixedwood	If necessary site prepare and plant softwoods in harvest openings	If necessary plant softwoods with, or without site preparation in harvest openings	Monitor survival and performance of softwood and hardwood natural regeneration
Hardwood	Leave for natural regeneration	Leave for natural regeneration	
Required Protection Methods	Road location, skid trails and harvesting to avoid clumps of advanced softwood understorey Leave patches of hardwood around clumps of softwood understorey	Skidding restricted to designated skid trails perpendicular to prevailing winds and topography	Must use predetermined trails for skidding Must leave unharvested strips between skid trails to provide additional windbreak Rub stumps must be placed along and at ends of trails
Optional Protection Methods	Rub stumps may be strategically placed throughout the block as required May leave single softwood trees without standing hardwood protection	Manitoba Conservation may waive the limbing at the stump requirement to prevent interference with regeneration of harvested areas and skid trails due to potential amounts of excessive slash	May restrict harvest to daytime operations only in parts of block with high amounts of understorey Manitoba Conservation may waive the limbing at the stump requirement

MANAGEMENT OF FOREST STANDS WITH SOFTWOOD UNDERSTORIES

Blocks should be subdivided into unique treatment units using pre-harvest survey results, leaf-off photographs and other detection methods to identify areas where different understorey protection strategies will be applied. Future forest inventories may identify softwood understories as an integral part of the forest inventory process.

The most appropriate understorey protection strategies for each unique treatment unit will be prescribed based upon the number and distribution of acceptable softwood understorey trees. An example of the composition of three unique treatment units and the prescribed understorey protection strategy is shown in Table 2.

Table 2. An example of the composition of three treatment units and the understorey protection strategy prescribed.

Treatment Unit	Forest Stand Description		Understorey Protection Strategy
	Overstorey	Understorey	
1	Trembling Aspen 100 %	Understorey 219 stems/ha in clumps	**Extensive**
2	Trembling Aspen 90%, White Spruce 10%	Understorey 270 stems/ha	**Moderate**
3	Trembling Aspen 80%, White Spruce 20%	Understorey 600 stems/ha distributed throughout	**Intensive**

The assignment of understorey protection methods (patches, shelter strips, single trees) will be based on several factors which reflect the understorey tree's ability to respond such as: tree species, age, health, density (stem/ha), distribution and windfirmness. The assignment of appropriate methods will also take into consideration the specific goals for each site.

Figure 1 depicts an example of the results of using designated skid trails and unharvested strips as understorey protection strategies.

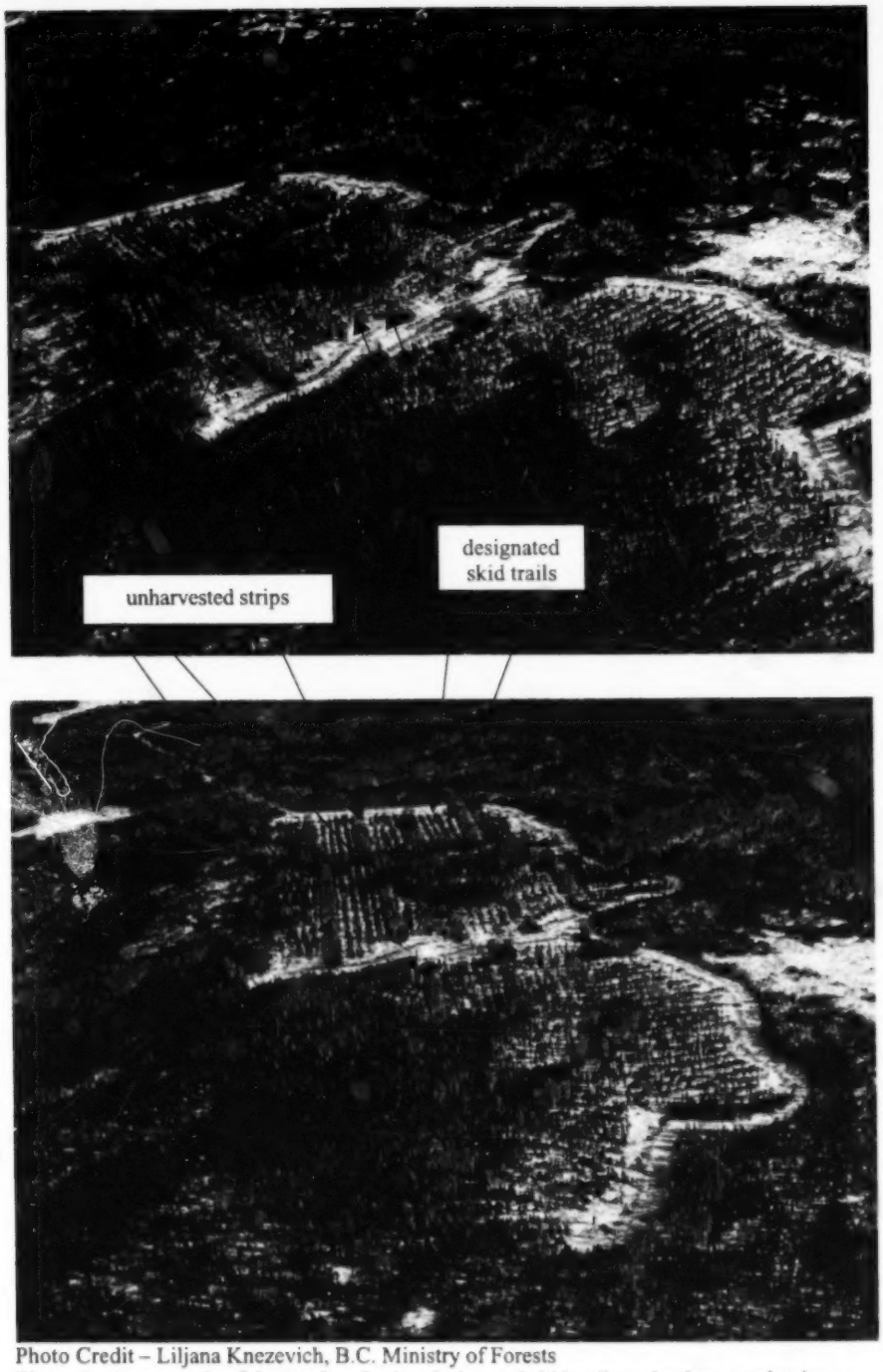

Photo Credit – Liljana Knezevich, B.C. Ministry of Forests
Figure 1. An example of the results of using designated skid trails and unharvested strips as understorey protection strategies.

OPERATIONS SUPERVISION

Timber harvest operations supervisors must be fully aware of the Understorey Protection Strategy including the Forest Renewal Prescription and Protection Methods to be employed on each site. Experience of supervisors and operators is essential to ensure that protection is successful and objectives are achieved.

On sites where understorey protection is prescribed, operations supervisors will conduct inspections before logging starts and regularly during operations to reassess site conditions and operator performance. Patches of understorey softwood trees that are significant because of the values they offer should be mapped on aerial photographs and specific instructions for their protection conveyed to operators. More frequent and direct supervision may be required when intensive understorey protection methods are employed or when operators have less than adequate experience with understorey protection.

ANTICIPATED RESULTS

PROTECTION AND MORTALITY

Within the net area where understorey protection is implemented (excluding skid trails) 40-60% (Sauder 1992) of understorey stems are expected to be maintained. Additional losses of 15 – 25%, (Navratil, Brace, Sauder, and Lux 1994) during the first 3-5 years post harvest, can also be expected due to wind throw and other causes of mortality.

DAMAGE

Some wounding of the protected softwood understorey should be anticipated during harvesting practices. If unacceptable damage occurs on unmerchantable stems during the harvest phase the damage should be noted and the trees not considered as acceptable regeneration. The Canadian Forest Service (CFS) research Project 1480 incorporated the use of many damage codes to describe wounds. Subsequent reports (NOR-X-337) and staff at the CFS (Lux 1998) recommended the use of fewer general damage descriptions.

This list of acceptable and unacceptable damages incurred during protection include:

UNACCEPTABLE DAMAGES

a) broken stem $\geq$ 2 m from top
b) cambium scrape $\geq$ 1/3 of stem circumference
c) any single cambium/bark scrape > 400 cm^2
d) gouge into sapwood
e) up-rooted
f) leaning > 45° from vertical
g) supporting root within 1 m of tree stem damaged

ACCEPTABLE DAMAGES

a) broken or lost leader < 2 m from top
b) broken branches
c) cambium scrape < 1/3 of stem circumference

During active timber harvest operations fallen or damaged merchantable trees will be taken. If, after timber harvest operations conclude, there is significant blowdown or damage Manitoba Conservation will determine whether fallen or damaged merchantable trees should be taken. The merchantable value and ecological benefits of the fallen trees, the risk of damage to protected trees, and other values will be considered in the final decision regarding salvage.

SITE SPECIFIC FOLLOW UP ASSESSMENTS

FOREST RENEWAL

Forest companies are required to assess sites to confirm that forest renewal prescriptions have been effective. If the forest renewal prescription has not been effective, other measures may have to be prescribed to ensure the softwood component of mixedwood forest stand is re-established. Site preparation and/or planting of acceptable softwood seedlings may be required to supplement or replace understorey protection. Site preparation must avoid the rooting zones of protected understorey trees. Every effort must be taken during forest renewal activities to maintain the understorey protection achieved during harvest operations.

FINAL MANITOBA CONSERVATION TIMBER INSPECTION

Manitoba Conservation's final timber inspection will confirm the implementation of understorey protection strategies.

FUTURE STUDIES

ASSESSING THE SUCCESS OF UNDERSTOREY PROTECTION

Because understorey protection is a relatively new practice in Manitoba the intent is to acquire evidence that understorey protection strategies and methods promoted in this guidebook are successful. Forest companies and Manitoba Conservation will assess the success of applied understorey protection strategies to meet forest renewal requirements. With this information and the experience developed in the intervening period we will be able to develop practices through adaptive management. Long-term study plots should be established by forest companies to refine survival, growth, and succession expectations.

GLOSSARY

Annual Operating Plans (AOP) – Plans prepared and submitted annually by timber operators describing how, where and when to develop roads, harvest timber, and complete renewal of the forest. AOP's describe the integration of operations with other resource users, the mitigation of the impacts of logging, the reclamation of disturbed sites, and the reforestation of harvested areas.

Advanced regeneration – The young tree growing under an existing stand before it is logged. If advanced regeneration survives the logging operation it may form an initial part of the new stand.

Block – Area in which the Pre-Harvest survey is performed for forest management activities (Forest Practices Committee – 2001).

Ecological conditions – A variety of conditions including climate, soil, and topography that influence the vegetative composition of a forest.

Forest Management Licencees (FML) – Forest companies that have agreements with the Province of Manitoba in regards to the management of their licenced areas.

Forest Practices: Activities that are conducted in the forest during all stages of forest management operations (e.g. surveys, harvesting, road construction, silviculture).

Forest renewal prescription – A detailed plan for returning a harvested area to productive forest.

Guidebook: A collection of policies, guidelines, procedures and standards related to a specific Forest Practice.

Guideline: A guideline presents alternative procedures or standards that practices may incorporate to satisfy the principle upon which the guideline is based. To be enforceable a specific guideline must be stated on a Work Permit.

IRMT – Integrated Resource Management Teams, consisting of Manitoba government regional resource staff.

Mitigation – Actions taken during the planning, design, construction and operation of works and undertakings to alleviate potential adverse effects on the land base.

Policy: A deliberately chosen course of action. Policy in this document refers to governing principles and corresponding procedures and standards of the Provincial government.

Procedures: Steps taken to implement a policy or guideline.

Standards: Standards are established benchmarks that the implementation of a procedure can be measured against. They may be strict targets that must be achieved or exceeded, or they may be general goals against which implementation is measured

Sustainable forest management –A forest management regime that maintains the productive and renewal capacities, as well as the genetic, species and ecological diversity of forest ecosystems. (Dictionary of Natural Resources Management - Dunster and Dunster, 1996)

Understorey trees – The trees growing under the canopies of the other larger adjacent trees.

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